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short report

Psychometric properties of the revised Developmental Behaviour Checklist scales in Dutch children with intellectual disability

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Abstract

The present study assessed the reliability and validity of the revised scales of the Developmental Behaviour Checklist (DBC) in a Dutch sample of children with intellectual disability (ID). The psychometric properties of the parent and teacher versions of the DBC were assessed in various subsamples derived from a sample of 1057 Dutch children (age range = 6–18 years) with ID or borderline intellectual functioning. Good test–retest reliability was shown both for the parent and teacher versions. Moderate inter-parent agreement and high one-year stability was found for the scale scores. Construct validity was satisfactory, although limited by high informant variance. The DBC scales showed good criterion-related validity, as indicated by significant mean differences between referred and non-referred children, and between children with and without a corresponding DSM-IV diagnosis. The reliability and validity of the revised DBC

scales are satisfactory, and the checklist is recommended for clinical and research purposes.

Keywords Developmental Behaviour Checklist, psychometric properties, psychopathology, reliability, validity

Introduction

Many children (henceforward also denoting adolescents) with intellectual disability (ID) have considerable emotional and behavioural problems, which can be an additional burden to the lives of both the children and their parents. Prevalence estimates of psychopathology in children with ID range from 14% to more than 80% (Bregman & Hodapp 1991; Borthwick-Duffy 1994). Compared to children from the general population, children with ID are about four to eight times more likely to show deviant levels of emotional and behavioural problems (Rutter *et al.* 1970; Koller *et al.* 1982; Linna *et al.* 1999). The large differences in prevalence are mainly attributable to the use of different samples (e.g. referred and community samples), variance in definitions of psychopathology and the lack of use of standardized instruments to assess psychopathology (Singh *et al.* 1991; Borthwick-Duffy 1994).

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Assessment of emotional and behavioural problems among children with ID is complicated. First of all, these children are less likely to be able to report on their own experiences and feelings, making it desirable to use parents and teachers as important sources of information (Dykens 2000). Secondly, confounding factors of both conditions can make it difficult to decide whether certain behaviours are caused by mental disturbance or ID (Lovell & Reiss 1993; Borthwick-Duffy 1994), emphasizing the importance of establishing separate norms for children with ID. Furthermore, these children are likely to show deviant behaviours that are seldom reported for children without ID, such as self-absorbed behaviours (e.g. eating non-food, humming and grunting), communication disturbances (e.g. echolalia and confusing pronouns) and social relating problems (e.g. avoiding eye contact and not showing affection) (Einfeld & Aman 1995; Einfeld & Tonge 1995). This suggests that there is a surplus value in using instruments specifically designed for children with ID to assess emotional and behavioural problems over instruments used in general child mental health care, such as the Child Behavior Checklist (CBCL; Achenbach 1991a).

Given the problems in defining psychopathology in children with ID, and the need to improve the assessment of mental health problems in this under-diagnosed and under-treated group, reliable standardized instruments assessing a broad range of emotional and behavioural problems are necessary.

Aman (1991) refrained from recommending any instruments for general use in children with ID, mostly because of the lack of decent standardization and inadequate field-testing of the available instruments. However, the above author mentioned some promising instruments, including the Reiss Scales for Children's Dual Diagnosis (Reiss & Valenti-Hein 1994), the Aberrant Behavior Checklist (ABC; Aman *et al.* 1985; Freund & Reiss 1991) and the Developmentally Delayed Child Behaviour Checklist (DD-CBCL; Einfeld & Tonge 1992). After Aman's (1991) review, the development of these instruments progressed. Of these, the DD-CBC, now called the Developmental Behaviour Checklist (DBC), has attractive properties. Both a primary carer (DBC-P) and a teacher version (DBC-T) are available. Most of the original six scales of the DBC (i.e. Disruptive, Self-absorbed, Communication

Disturbance, Anxiety, Social Relating and Antisocial) had satisfactory internal consistency, as well as good test-retest reliability. Furthermore, the DBC has been shown to have good content and convergent validity, and good specificity and sensitivity with regard to expert clinician judgement of the subject as a psychiatric case or non-case (Einfeld & Tonge 1992, 1995; Einfeld *et al.* 1998). Because it had demonstrated good psychometric properties in an Australian sample, both the parent and teacher versions looked very promising for use in the Netherlands.

The DBC scales were recently revised. The use of a large Australian-Dutch sample, representative of the entire spectrum of ID, resulted in five scales, i.e. Disruptive/Antisocial, Self-absorbed, Communication Disturbance, Anxiety and Social Relating, which differed from the original scales in item composition, and were easily interpretable and internally consistent (Dekker *et al.* 2002). The present study investigated the reliability and validity of these new DBC scales.

The first goal of this study was to assess the reliability of the revised DBC scales in children aged between 6 and 18 years attending schools for the educable and trainable, or visiting a day-care centre for people with ID in the Netherlands. To this end, the internal consistencies, the test-retest reliabilities, and the inter-rater agreements of the DBC filled out by parents (DBC-P) and teachers (DBC-T) were determined.

Secondly, the present authors aimed to assess the validity of the DBC scales. In the absence of an objective or definite standard criterion, they addressed the convergence of the measured DBC constructs with similar constructs from other instruments assessing psychopathology. In several studies, the CBCL (Achenbach 1991a; Verhulst *et al.* 1996) and the TRF (Achenbach 1991b; Verhulst *et al.* 1997), which were originally developed for the non-ID population, were used in samples of children with ID and showed promise (Curfs *et al.* 1991; Floyd & Zmich 1991; Pueschel *et al.* 1991; Floyd & Saitzyk 1992; Floyd & Phillippe 1993; Borthwick-Duffy *et al.* 1997; Van Lieshout *et al.* 1998). The present authors expected a high positive correlation between the DBC-P/DBC-T and CBC/TRF scales representing similar syndromes of psychopathology. The

discriminant validity of the DBC was addressed by examining the divergence between scales supposed to tap different dimensions of psychopathology, and between DBC scales and measures of adaptive functioning assessed with the Vineland Screener (Sparrow *et al.* no date).

To examine criterion-related validity, comparisons were made between scale scores of children referred for emotional and behavioural problems versus non-referred children, as reported by their parents. However, referral to mental health care is not a perfect criterion for the presence and severity of the emotional and behavioural problems of a child. Apart from behavioural and emotional problems other factors, such as motivation and knowledge of parents to search for help, parents' own mental well-being, resilience of the family, and availability of care, also influence referral status (Verhulst *et al.* 1996). Therefore, the present authors also examined the power of several DBC-P scales to discriminate between children with a corresponding DSM-IV diagnosis (Axis I, including Anxiety Disorder, Mood Disorder and Disruptive Disorder).

Materials and methods

Sample and procedure

Initial sample

In 1997, a 20% random sample was selected from all students in 115 (87.1%) out of the 132 non-residential school settings for the educable (inclusion IQ range \approx 60–80) and the trainable (inclusion IQ range \approx 30–60) in the province of Zuid-Holland ($n=1615$). Additionally, 20% of the children from 23 (95.8%) out of 24 day-care centres for children with ID (IQ < 50, many with additional physical or sensory handicaps) were randomly recruited ($n=132$). Children were only included in the sample if: (1) they were between 6 and 18 years old; (2) they lived at home for ≥ 4 days a week; and (3) at least one parent had enough comprehension of the Dutch language to be interviewed. The parents and caregivers of the sampled children were sent a letter through the schools because the research team could not initiate direct contact with the parent because of privacy regulation. After receiving

written consent, the parents were contacted by telephone or visited at home. The schools sent a reminder to those parents who did not respond to the initial letter, and if possible, non-responding parents were telephoned. Parents were interviewed at home between November 1997 and July 1998.

Out of the selected subjects, 145 were excluded because of parental language problems, eight because they exceeded the age range, and 76 because they had left their school or day care centre, or moved during the period of data collection. Out of the final number of 1518 eligible subjects, 188 parents refused to participate, 23 did not fill out the DBC-P, although they consented to participate in the study, and in 250 cases, the non-responding parents could not be contacted by telephone. The final response rate for the DBC-P, based on all eligible subjects, was 69.6% ($n=1057$; 83.4% of those contacted in person by the research team). After the written consent of the parents was received, teachers and group workers were sent a DBC-T by mail and 930 out of 1134 questionnaires were returned (82.0%); DBC-T information was available for 82.2% of the children for whom also a DBC-P was completed. In all, a DBC-P or a DBC-T was completed for 1118 children (74.3%), of whom 64.1% attended a school for the educable, 28.6% a school for the trainable and 7.2% a day care centre for children with ID. The mean age of the subjects was 12.1 years ($SD=3.1$ years), 60.1% were male, and 56.1%, 28.8% and 15.2% of the children came from families with low, medium and high socio-economic status (SES), respectively.

In addition, the parents filled out the CBCL (Achenbach 1991a) and the teachers filled out the TRF (Achenbach 1991b). Parents were interviewed with the Vineland Screener (Sparrow *et al.* no date) and gave information about their child's contacts with mental health care services.

No significant differences were found in the distribution of sex ($\chi^2_1=3.4$, $P=0.07$) and year of birth ($t_{1477}=-1.1$, $P=0.29$) between children for whom a DBC was completed and for those for whom this was not the case. There was a differential dropout by educational level and SES, with fewer schools for the educable agreeing to participate ($\chi^2_2=8.5$, $P<0.02$), a lower response rate by both these schools and day care centres ($\chi^2_2=30.2$, $P<0.001$), and a larger proportion of children from

low-SES families in the non-participating group ($\chi^2_2 = 11.1$, $P = 0.004$).

DBC-P test-retest sample

The test-retest reliability of the DBC-P scales was assessed by having a random sample of 88 parents complete the DBC-P twice, with a mean interval of 17 days ($SD = 7.7$ days). Out of the 114 eligible parents, 26 refused to fill out the DBC-P a second time.

DBC-T test-retest sample

The test-retest reliability of the DBC-T scales was addressed by having a random sample of 69 teachers complete the DBC-T twice, with a mean interval of 18.9 days ($SD = 7.4$ days). Out of the 87 eligible teachers, 18 did not return the second DBC-T.

Inter-parent agreement sample

The inter-parent agreement was addressed by having a random sample of 96 spouses complete the DBC-P, with a mean interval of 10.9 days ($SD = 8.0$ days). Out of the 118 eligible families, 22 spouses refused to participate.

Follow-up sample

About one year later (time 2), the present authors contacted a random sample of 55% of the time 1 respondents ($n = 557$) for a second time. Six families were excluded because they did not meet the language requirements for the more complicated diagnostic interview to be held at this time, and five children were no longer living at home (eligible $n = 546$). At time 2, the authors were not able to get in contact with 11 parents, 51 refused to participate and eight parents did not fill out the DBC-P. A DBC-P was filled out by 474 parents (86.8%) for whom a valid time 1 DBC-P was available, with a mean time interval of 409.6 days ($SD = 79.9$ days). These parents also completed the Diagnostic Interview Schedule for Children (DISC-P; Shaffer *et al.* 2000; Dutch translation Ferdinand, van der Ende & Mesman). In addition, the parents were interviewed with the Columbia Impairment Scale (CIS; Bird *et al.* 1993, 1996).

No significant differences between the children of responders and non-responders were found for any of the time 1 DBC-P scale scores (all $P > 0.05$), their time 1 age ($t_{544} = 1.5$, $P = 0.13$) or type of school ($\chi^2_1 = 0.1$, $P = 0.74$). Time 2 non-responders were more likely to be the parents of girls ($\chi^2_1 = 6.6$, $P = 0.01$) and to have a low SES ($\chi^2_2 = 15.9$, $P = 0.001$) than time 2 responders.

At time 2, the sample consisted of 77.4% of children originally attending a school for the educable and 22.6% attending a school for the trainable, which is as expected. The mean age was 12.9 years ($SD = 3.0$), and 61.8% of the subjects were male. Almost 50%, 32.8% and 16.3% of the children came from families with low, medium and high SES, respectively.

Instruments

DBC-P

The DBC-P (Einfeld & Tonge 1992, 1995; Dutch translation Koot & Dekker) is a 96-item checklist to be completed by parents or caregivers, and designed to assess a broad range of behavioural and emotional problems in children and adolescents with ID. Most respondents can complete the DBC in 15–20 min. The six original empirically derived subscales have shown good reliability. The Cronbach's alphas of the DBC-P range from 0.67 to 0.91. Test-retest reliabilities, using intra-class correlations (ICCs) range from 0.51 to 0.87, and the inter-parent agreement ICC is 0.80. Furthermore, the DBC-P has been proven to have good convergent validity, as shown by a 0.86 correlation between the Total Problems scores of the DBC-P and the Maladaptive Behaviour section of the Adaptive Behaviour Scale (ABC; Nihira *et al.* 1975). Finally, the DBC-P has known sensitivity and specificity with regard to expert clinician judgement of the subject as a psychiatric case or non-case, with an area under the Receiver Operating Characteristics (ROC) curve of 92% (Einfeld & Tonge 1992, 1995).

DBC-T

The DBC-T (Einfeld *et al.* 1998; Parmenter *et al.* 1998; Dutch translation Koot & Dekker) is the

94-item teacher version of the DBC-P to be completed by teachers or teacher's aids, and designed to assess a broad range of behavioural and emotional problems in children and adolescents with ID. All items have a counterpart on the DBC-P, except for three items related to sleep disturbance that have been deleted and one item that has been added, i.e. Unpopular with other children. Factor analysis using DBC-T data alone has yielded a factor structure similar to that of the factor structure from combined DBC-P and DBC-T data (Einfeld *et al.* 1998). No published data is available on the internal consistency or test-retest reliability of the DBC-T scales. The inter-rater reliability (intra-class correlation teacher-aide) of the DBC-T Total Problems score has been found to be 0.60 (Einfeld *et al.* 1998). The correlation between the DBC-P and the DBC-T Total Problems score is low ($r=0.05$). However, this is consistent with other studies that have found low agreement between parents' and teachers' ratings of psychopathology (e.g. Rutter *et al.* 1970; Achenbach *et al.* 1987).

The present study uses the DBC-P and DBC-T scales that were recently re-evaluated in a combined sample of 1536 Dutch and Australian children (age = 3–22 years) representative of all levels of ID (Dekker *et al.* 2002). The results were largely consistent across parents and teachers. Five well-interpretable scales were obtained, i.e. Disruptive/Antisocial, Self-absorbed, Communication Disturbance, Anxiety and Social Relating, explaining 43.7% of the total variance. The Disruptive/Antisocial scale (27 items) includes a variety of acting-out problems, such as being abusive, swearing, lying, being disobedient, being manipulative and stealing. The Self-absorbed scale (31 items) includes items, such as eating non-food, humming, mouthing objects, and biting others. The Communication Disturbance scale (13 items) includes behaviours, such as echolalia, talking to oneself or imaginary people or objects, confusing pronouns, and repeating words or phrases. The Anxiety scale (nine items DBC-P; eight items DBC-T) includes items related to elevated anxiety, such as distressed when separated, distressed when being alone, nightmares, and fearing things or situations. Finally, the Social Relating scale (10 items DBC-P; nine items DBC-T) includes items like being under-

active, not showing affection, being depressed or unhappy, and sleeping too much. In the combined Dutch–Australian sample, the Cronbach's alphas of these five scales ranged from 0.66 to 0.91 for the DBC-P, and from 0.62 to 0.91 for the DBC-T.

CBCL and TRF

The CBCL and TRF (Achenbach 1991a,b) are standardized reports on children's emotional and behavioural problems over the preceding 6 months, as reported by parents and teachers. Good reliability and validity have been demonstrated for the Dutch CBCL and TRF (Verhulst *et al.* 1985a, b, 1996, 1997; de Groot *et al.* 1994, 1996). In the present sample, a mean Cronbach's alpha of 0.73 for the CBCL scales and of 0.77 for the TRF scales was found for children attending schools for the educable and trainable. The Cronbach's alphas for the CBCL and TRF scales were highly comparable to those reported for the Dutch general population and referred samples (Verhulst *et al.* 1996, 1997).

Vineland Screener

The Vineland Screener was designed as a measure of the personal and social sufficiency of individuals from birth to 19 years of age for the purpose of screening large groups, and it can be administered to the parent or caregiver of the child by a trained interviewer. From a pool of 261 items from the Vineland Adaptive Behavior Scales (VABS; Sparrow *et al.* 1984), 45 items were selected on the basis of ease of administration, reliability, domain coverage and strength of correlation with the total scales (Sparrow *et al.* no date). In the 6- to 18-year-old age range, the Vineland Screener addresses the domains Communication, Daily Living Skills and Socialization. The Vineland Screener has been standardized on a large representative American sample and is compatible with the normative tables in the Vineland Survey Form Manual. Correlations between the equated Vineland Screener domain raw scores and the Vineland full-scale domain standard scores range from 0.92 to 0.95 for 6- to 18-year-olds (Sparrow *et al.* no date).

Referral status

During a home interview, parents were asked if their child was ever referred, examined, treated, or admitted to hospital for emotional or behavioural problems.

Diagnostic Interview Schedule for Children – Parent Version

The Diagnostic Interview Schedule for Children – Parent Version (DISC-IV-P) is designed to obtain DSM-IV diagnoses and to be administered by well-trained interviewers who do not need to have formal clinical training. The preliminary results of the National Institute of Mental Health DISC-IV showed that this version has moderate to good test–retest reliability and moderate to good agreement with clinicians' ratings (Shaffer *et al.* 2000). With the permission of the original authors, the DISC-IV was translated into Dutch (Ferdinand, van der Ende & Mesman), following the original text as closely as possible. Parents were interviewed by one of 13 trained lay interviewers. In this study, the present authors administered questions addressing Anxiety Disorders (i.e. separation anxiety disorder, panic disorder, agoraphobia, specific phobia, social phobia, obsessive–compulsive disorder, post-traumatic stress disorder, generalized anxiety and selective mutism), Mood Disorders (i.e. major depressive disorder, dysthymic disorder, manic disorder and hypomanic disorder) and Behaviour Disorders (attention-deficit/hyperactivity disorder, conduct disorder and oppositional defiant disorder). The DSM-IV diagnoses were derived from DISC-IV-P scores by applying algorithms provided by the authors of the DISC-IV.

Columbia Impairment Scale

The Columbia Impairment Scale (CIS) is a 13-item scale covering four major areas of functioning: (1) interpersonal relations; (2) broad areas of psychopathology; (3) functioning at school or work; and (4) use of leisure time. Items are scored from (0) 'no problem' to (4) 'a very bad problem' (Bird *et al.* 1993). The CIS can be administered to the parent of the child by a trained lay interviewer. Good reliability was found, as well as good construct, discriminant and concurrent validity (Bird

et al. 1993, 1996). The optimal threshold ≥ 16 recommended by Bird *et al.* (1996) was used to distinguish between those with definite impairment and all others.

Results

Reliability of the DBC

The reliabilities of the DBC-P and the DBC-T are given in Table 1. The Cronbach's alphas of the revised DBC scales in the Dutch sample ranged from 0.66 to 0.91 (mean = 0.78) for the DBC-P and from 0.67 to 0.91 (mean = 0.79) for the DBC-T. The test–retest reliabilities, assessed by the intra-class correlation (Shrout & Fleiss 1979), ranged from 0.76 to 0.89 (mean = 0.84) for the DBC-P and from 0.69 to 0.91 (mean = 0.79) for the DBC-T. Inter-parent, intra-class correlation coefficients ranged from 0.52 to 0.67 (mean = 0.61).

Stability of the DBC-P

As shown in Table 1, Pearson product-moment correlation coefficients between DBC-P scale scores over a one-year period ranged from 0.66 to 0.75 (mean = 0.70).

Construct validity of the DBC

First, convergent validity was assessed by correlating the corresponding DBC-P and DBC-T scales (see Table 1). All Pearson correlation coefficients were significantly different from zero (all $P < 0.001$) and were predominantly in the medium range according to Cohen's (1988) criteria. The Total Problems scales of both instruments showed a correlation of 0.42. The correlation coefficients ranged from 0.29 for the Anxiety scales to 0.57 for the Self-absorbed scales. The mean correlation between similar scales of the DBC-P and DBC-T was 0.39. All correlation coefficients between dissimilar scales were smaller than their convergent validities, except for one: the Self-absorbed scale of the DBC-P showed a correlation of 0.41 with the Communication Disturbance scale of the DBC-T, while the correlation between both Communication Disturbance scales was 0.35. Finally, 82% of the correlation coefficients between dissimilar scales of the

Table 1 Cronbach's alpha, test-retest reliability for parents (Ps) and teachers (Ts), inter-parent agreement, one-year stability, and parent-teacher agreement of the Developmental Behaviour Checklist Parent (DBC-P) and Teacher (DBC-T) versions

DBC scale	DBC-P			DBC-T			
	Cronbach's alpha (<i>n</i> = 1057)	Test-retest ICC* (99%CI) (<i>n</i> = 88)	Inter-parent ICC (99%CI) (<i>n</i> = 80)	One-year stability† (<i>n</i> = 474)	Cronbach's alpha ICC (99%CI) (<i>n</i> = 930)	Test-retest ICC (99%CI) (<i>n</i> = 69)	Parent-teacher agreement† (<i>n</i> = 851)
Disruptive/Antisocial	0.91	0.85 (0.75–0.91)	0.64 (0.43–0.78)	0.74	0.91	0.87 (0.76–0.93)	0.37
Self-absorbed	0.88	0.86 (0.77–0.92)	0.67 (0.47–0.80)	0.75	0.88	0.91 (0.83–0.95)	0.57
Communication Disturbance	0.74	0.82 (0.71–0.90)	0.57 (0.34–0.73)	0.67	0.74	0.73 (0.54–0.84)	0.35
Anxiety	0.66	0.89 (0.82–0.94)	0.52 (0.28–0.70)	0.66	0.67	0.69 (0.48–0.82)	0.27
Social Relating	0.72	0.76 (0.62–0.86)	0.65 (0.45–0.79)	0.67	0.75	0.75 (0.57–0.86)	0.39
Total Problems	0.95	0.86 (0.77–0.92)	0.55 (0.31–0.72)	0.75	0.94	0.85 (0.74–0.92)	0.42

* For all Intra Class Correlation (ICC) coefficient, $P < 0.001$, 99%CI = 99% Confidence Interval.† For all Pearson product-moment correlation coefficients, $P < 0.001$.

DBC within the same informant exceeded the correlation coefficients between similar scales of the DBC across informants, suggesting high informant variance.

Next, convergent validity between corresponding scales of the DBC-P and the CBCL ($n = 1040$), and the DBC-T and the TRF ($n = 850$) was assessed (see Table 2). The correlation between the Total Problem scales of both instruments was 0.85, and the average correlation between similar scales was 0.63 for both parents and teachers. The correlation between the Disruptive/Antisocial scale of the DBC-P and the Aggressive scale of the CBCL, and between the Social Relating scale of the DBC-P and the Withdrawn scale of the CBCL exceeded 0.70. Similar results were found for the teacher versions of both instruments. Moderate to high correlations (cf. Cohen 1988) were also found between the DBC Disruptive/Antisocial scale, and the CBCL/TRF Attention Problems scale and Delinquent Behaviour scale, as well as between the DBC Anxiety and Social Relating scale and the CBCL/TRF Anxious/Depressed scale.

Out of the 132 comparisons between dissimilar constructs of DBC and the CBCL/TRF, 17 exceeded their corresponding convergent validity coefficients

Table 2 Pearson correlation coefficients* between corresponding Developmental Behaviour Checklist Parent Version (DBC-P) and Child Behavior Checklist (CBCL) scales, and DBC Teacher Version (DBC-T) and Teacher's Report Form (TRF) scales

Corresponding DBC-CBCL/TRF scales	DBC-P-CBCL (<i>n</i> = 1040)	DBC-T-TRF (<i>n</i> = 850)
Disruptive/Antisocial– Aggressive Behaviour	0.85	0.87
Disruptive/Antisocial– Delinquent Behaviour	0.62	0.64
Disruptive/Antisocial– Attention Problems	0.62	0.60
Anxiety–Anxious/Depressed	0.51	0.50
Social Relating–Withdrawn	0.71	0.73
Social Relating–Anxious/ Depressed	0.47	0.43
Total Problems–Total Problem Score	0.85	0.85

* For all Pearson product-moment correlation coefficients, $P < 0.001$.

(12.9%). Some high correlation coefficients were found between constructs that were not *a priori* hypothesized to be similar; for example, for parents, a correlation of 0.67 was found between the Self-absorbed scale and the Attention Problems scale, and a correlation of 0.60 was found between the Disruptive/Antisocial scale and the Anxious/Depressed scale. A high correlation between the Self-absorbed scale and the Attention Problems scale was also found for teachers ($r = 0.71$).

Finally, discriminant validity was assessed by relating the DBC scales to three domains of adaptive behaviour, i.e. Communication, Daily Living Skills and Socialization, as assessed with the Vineland Screener. The correlations between the DBC Self-absorbed, Communication Disturbances and Social Relating scales, and the three domains of the Vineland Screener ranged from -0.20 to -0.41 (see Table 3). The correlations between the Total Problems scales of the DBC-P and DBC-T, and the Total Adaptive Functioning scale of the Vineland Screener were -0.32 and -0.31 , respectively.

Criterion-related validities of the DBC-P and DBC-T

Criterion-related validity was assessed by comparing the scale scores of all children who had ever been referred to mental health services with those of children who never have been referred and by comparing the scale scores of children with a DSM-IV diagnosis with those without one. The mean scores of children who at least once in their life had been referred for professional help for emotional and behavioural problems, and children who were never referred for this type of help are shown in Table 4 for both the DBC-P and DBC-T. Children who had ever been referred showed the highest mean scores on all DBC scales. Mean DBC Total Problem scores for referred children were about one standard deviation above the mean of children who were never referred. Percentages of explained variance in DBC scores accounted for by referral status obtained from analyses of variance (ANOVAs) accounting for sex, age and SES differences ranged from 1.9% to 12.0%, indicating small to moderate effects (Cohen 1988). Few and small

Table 3 Significant Pearson correlation coefficients between Developmental Behaviour Checklist Parent (DBC-P) and Teacher (DBC-T) versions scales and the domains of adaptive functioning of the Vineland Screener*

DBC scale	DBC-P ($n = 1032$)				DBC-T ($n = 863$)			
	Communication	Daily living skills	Socialization	Total adaptive functioning	Communication	Daily living skills	Socialization	Total adaptive functioning
Disruptive/Antisocial	ns	ns	-0.20	-0.11	-0.11	ns	-0.14	-0.12
Self-absorbed	-0.33	-0.41	-0.40	-0.43	-0.30	-0.36	-0.30	-0.37
Communication Disturbance	-0.29	-0.33	-0.33	-0.37	-0.26	-0.29	-0.25	-0.31
Disturbance								
Anxiety	-0.06	-0.11	-0.12	-0.11	-0.17	-0.25	-0.21	-0.24
Social Relating	-0.23	-0.23	-0.37	-0.31	-0.20	-0.20	-0.27	-0.26
Total Problems	-0.22	-0.27	-0.35	-0.32	-0.25	-0.26	-0.28	-0.31

* For all reported Pearson product-moment correlation coefficients, $P < 0.05$. ns = not significant.

Table 4 Percentage of variance explained in the Developmental Behaviour Checklist (DBC) by referral status (i.e. ever received help for emotional and behavioural problems, as reported by parents) and demographic variables [i.e. sex, age (6–12 and 13–18 years) and socio-economic status (SES; i.e. low, medium or high)] on the DBC Parent (DBC-P) and Teacher (DBC-T) scales*

DBC scale	DBC-P (n = 1057)								DBC-T (n = 869)							
	Referral status				Referral status [†]	Sex [‡]	Age [§]	SES [¶]	Referral status				Referral status [†]	Sex	Age	SES
	Help ever (n = 470)		No help (n = 587)						Help ever (n = 388)		No help (n = 481)					
	Mean	SD	Mean	SD					Mean	SD	Mean	SD				
Disruptive/Antisocial	16.9	10.1	9.3	7.3	12.0 ^R	–	–	2.2 ^L	10.9	8.7	7.1	7.1	4.4 ^R	2.5 ^M	2.6 ^Y	–
Self-absorbed	11.1	8.6	5.4	5.5	10.6 ^R	1.5 ^M	1.8 ^Y	–	7.4	7.4	4.1	5.2	3.7 ^R	0.6 ^M	0.7 ^Y	–
Communication Disturbance	5.3	4.2	3.0	3.2	6.9 ^R	–	–	0.1 ^H	2.7	3.4	1.6	2.3	3.8 ^R	–	–	–
Anxiety	4.3	3.1	2.8	2.6	5.9 ^R	0.8 ^F	1.3 ^Y	–	2.2	2.4	1.6	2.0	1.9 ^R	0.5 ^F	–	–
Social Relating	4.4	3.3	2.2	2.6	9.1 ^R	–	1.9 ^O	–	3.6	3.1	2.3	2.6	4.7 ^R	–	–	–
Total Problems	42.9	22.9	23.7	17.3	14.4 ^R	–	–	–	27.5	19.4	17.2	15.2	6.1 ^R	0.9 ^M	1.0 ^Y	–

*Only significant ($P < 0.05$) main effects are reported.

[†]R: referred children scored higher.

[‡]M: male participants scored higher; F: female participants scored higher.

[§]Y: younger children (6–12 years) scored higher; O: older children (13–18 years) scored higher.

[¶]L: low SES scored higher; H: high SES scored higher.

effects were found for the demographic variables (see Table 4).

Next, ANOVAs showed that, after adjustment for sex, age and SES differences, the mean DBC-P scales at time 2 varied significantly with meeting the criteria for a corresponding DSM-IV diagnosis (see Table 5). Children could meet the criteria for any of the following DSM-IV diagnoses: Anxiety Disorder, Disruptive Disorder or Mood Disorder (defined by a dysthymic disorder or major depression). Any disorder was defined by meeting the criteria for at least one of these disorders. In addition, children differed in whether or not they showed definite signs of impairment, as indicated by a CIS score of ≥ 16 . *Post hoc* Bonferroni pairwise comparisons showed that children who met DSM-IV criteria for Any Disorder, Anxiety Disorder or Disruptive Disorder, and who showed signs of definite impairment scored significantly higher on the corresponding DBC-P scales than children without signs of definite impairment. In turn, these children scored significantly higher on the corresponding DBC-P scales than those who did not meet the criteria for a DSM-IV disorder. A significant mean difference on the Social Relating scale of the DBC-P was only found between children who met the DSM-IV criteria for Mood Disorder and who showed definite signs of impairment versus children who did not meet the criteria for a DSM-IV diagnosis. Moderate to large effect sizes were found for Any Disorder, Disruptive Disorder and Anxiety Disorder (cf. Cohen 1988).

No significant main effects for the sex, age and SES demographic variables were found.

Discussion

The reliability of the scales was satisfactory for both the DBC-P and DBC-T, as shown by the high internal consistency of the scales Self-absorbed and Disruptive/Antisocial, and the moderate to high internal consistency for Communication Disturbance and Social Relating. The Anxiety scale showed somewhat lower internal consistency. Reliability was further confirmed by the good test-retest reliability of both the DBC-P and the DBC-T. The test-retest reliability of the DBC-P of 0.86 was similar to the test-retest reliability of 0.83 found in

Table 5 Means and percentages of explained variance (PEV) of Developmental Behaviour Checklist Parent Version (DBC-P) scales by corresponding DSM-IV diagnosis with or without definite impairment

Corresponding DBC scales-DSM-IV disorders*	Mean DBC scale [†]									
	DSM-IV criteria met + CIS ≥ 16			DSM-IV criteria met			DSM-IV criteria not met			PEV
	Mean	SD	n	Mean	SD	n	Mean	SD	n	
Total Problems-Any Disorder	53.4	21.2	72	34.3	20.7	110	18.6	13.8	278	26.3
Anxiety-Anxiety Disorder	5.7	3.2	47	4.2	3.0	61	2.2	2.1	352	11.2
Disruptive/Antisocial-Disruptive Disorder	25.0	9.5	52	18.2	9.5	63	8.8	7.0	346	24.9
Social Relating-Mood Disorder [‡]	6.2	2.7	17	3.0	4.2	2	2.8	2.8	454	4.9

* DSM-IV diagnosis (last year) based on standardized interview with the Diagnostic Interview Schedule for Children (DISC-IV) (Parent Version). Definite impairment is defined by a Columbia Impairment Scale (CIS) score ≥ 16 .

† *Post hoc* Bonferroni tests for pairwise comparisons of the observed means were all significant ($P < 0.01$), except for the pairwise comparison of the mean of the Social Relating scale between children who met the DSM-IV criteria for Mood Disorder versus children with No Mood Disorder, and between children who met the DSM-IV criteria for Mood Disorder versus children with a Mood Disorder plus definite signs of impairment.

‡ Mood Disorder is defined by dysthymic disorder or major depression.

the Australian sample from which the DBC was developed (Einfeld & Tonge 1992).

Even though the mean interval between inter-parent ratings of the DBC-P was 11 days, the present authors found a mean correlation of 0.61 between spouses, which is similar to the 0.59 correlation between similar role informants found in a large meta-analysis on cross-informant agreement on psychopathology (Achenbach *et al.* 1987). The inter-parent, intra-class correlation for the Total Problems score (0.55) was lower than the 0.80 correlation found in the original Australian sample (Einfeld & Tonge 1992). This might be explained by the time interval between the two ratings in the present study. In addition, it should be noted that intra-class correlations are not directly comparable with Pearson correlations.

Considerable one-year stability was found for the DBC-P, suggesting the absence of extreme changes in the ranking of problem behaviour over a one-year period. This was also found for problem behaviours in children in the general population (Verhulst & Koot 1995).

Parent-teacher agreement was only moderate. A moderate cross-informant agreement between parents and teachers on similar scales of psychopathology has been reported for many other instruments assessing psychopathology across samples of non-ID children (Achenbach *et al.* 1987). In the original Australian study, a parent-teacher intra-class correlation for the Total Problem score of 0.05 was found (Einfeld & Tonge 1995), which is lower than the 0.42 correlation found in the present study. Again, these two measures are not directly comparable. Situation specificity of problem behaviours is likely to contribute to the relatively low cross-informant correlation coefficients, especially in community populations, in which children may tend to show less situation-pervasive problems. Observer specificity can also play an important role; for example, different observers can have different perspectives, tolerance levels or thresholds for reporting behaviour (van der Ende 1999). A clearer picture of the meaning of this disparity between parent and teacher ratings may be obtained from future studies that employ structured behavioural observations in both the home and school environment, as well as parent and teacher reports.

Large informant effects for the DBC scales were suggested by the fact that the vast majority of the correlation coefficients between dissimilar scales of the DBC within the same informant exceeded the correlation coefficients between similar scales of the DBC across informants. Results from other studies using multi-trait, multi-method analyses (Fergusson & Horwood 1987; Greenbaum *et al.* 1994) have shown similar large informant effects. These analyses also indicate high co-occurrence of different behavioural/emotional problems. The high co-occurrence of different problem behaviours is a well-known phenomenon in child psychiatry. It is likely that apparent comorbidity results from a higher order pattern of co-occurring problems, or that two or more problem behaviours result from the same underlying cause (Verhulst & Koot 1992).

The present results suggest a moderate to high degree of convergent validity between corresponding scales of the DBC-P/DBC-T and the CBCL/TRF. Furthermore, the DBC-P Total Problems score correlated 0.85 with the CBCL Total Problem score. The same high correlation was found between the DBC-T and the TRF. These correlation coefficients are similar to the correlation of 0.86 found between the DBC-P and ABC (Aman *et al.* 1985) in the Australian study (Einfeld & Tonge 1992).

Finally, supportive evidence for discriminant construct validity was found in the present study. The Disruptive/Antisocial scale and the Anxiety scale of the DBC had small correlation coefficients with domains of adaptive functioning, indicating discriminant validity. The DBC Total Problems, Self-absorbed, Communication Disturbance and Social Relating scales showed moderate correlation coefficients with domains of adaptive functioning, suggesting that the level of adaptive functioning affected the scores on these scales. However, none of the correlation coefficients exceeded -0.41, indicating that the DBC and the Vineland Screener tap related but different concepts.

Evidence for the criterion-related validity of the DBC scales was demonstrated by significantly higher mean scores for children who had ever been referred for mental health services versus those who had never been referred. A more narrow definition of referral status, such as being referred to mental

health care in the past year, might have resulted in even larger mean differences. In addition, the mean DBC scale scores were significantly higher for children with a related DSM-IV diagnosis compared to children without a diagnosis. The mean DBC-P scale scores also differed significantly between children with or without definite signs of impairment in addition to a related DSM-IV diagnosis, except for Mood Disorder. These results indicate that the DBC-P scale scores reflect both presence and experienced severity of a related DSM-IV disorder.

It should be noted that all the measures of psychopathology used in the present study to validate the DBC do not make a perfect standard. The CBCL, the TRF and the DSM-IV taxonomy are not specifically designed and validated for children with ID. However, because there is a lack of any definite criteria to define psychopathology, the simultaneous use of multiple methods is viewed as an appropriate and useful way to validate instruments, as well as to come to a better understanding of psychopathology in children with ID (Aman 1991).

Clinical and research implications

Because the prevalence of psychopathology in children with ID is estimated to be much larger than in the general population (Rutter *et al.* 1970; Koller *et al.* 1982; Linna *et al.* 1999), the use of standardized, reliable and valid instruments to assess and record psychopathology, and to evaluate interventions, is needed in this under-diagnosed and under-treated group. The present study shows that the DBC-P and DBC-T can be valuable tools, as indicated by their good reliability and satisfactory validity. Other assets are their ease of administration, and the broad range of emotional and behavioural problems that can be assessed, making the DBC a useful structured information-gathering tool for clinical practice and research. The availability of Dutch (and Australian) standardized norm scores enables users to relate scale scores obtained for individual clients with those of a representative group of children with a similar level of ID. Distinction between probable cases and non-cases may be based on a well-chosen cut-point of scores. In the Australian study, a cut-off score for Total Problems at the sixtieth percentile was shown to be best

for discriminating between cases and non-cases, as ascertained by child psychiatrists' ratings (Einfeld & Tonge 1992). However, more research is needed to decide on which cut-off scores are optimal in discriminating cases from non-cases in groups with different levels of ID in different samples. Finally, the DBC or specific scales of the DBC can be used to measure effects of interventions in a standardized way. Where individual items may not have enough variance to be sensitive to small changes, scale scores and the Total Problem score may give adequate measures of change (Einfeld & Tonge 1992).

Although, significant differences in DBC mean scores were found for children with and without a DSM-IV diagnosis in the present study, more research is needed to see whether the DBC is successful as a screening tool for specific disorders, such as anxiety and autistic spectrum disorders (Brereton 2000; Gray & Tonge 2000). Furthermore, additional research is needed to clarify the issue to what extent the behavioural/emotional problems tapped by the DBC are primarily linked to psychopathology in the individual, or to contextual or environmental variables. This is an important issue, since treatment for behaviour problems resulting from environmental influences may be vastly different from treatment for individual psychopathology. As for now, the DBC is well-suited to tap behavioural and emotional problems that can be reliably reported by parents and teachers independent of the origin of the problems.

A limitation of the present study is that no direct observations of the child's behaviour by mental health professionals or researchers were available. Assessing the relation between the DBC scores and direct observations, and evaluation by professionals, should be an important focus in the continuing validation process of the DBC. The use of the DBC in referred samples will give important additional information on the discriminative power of the DBC regarding the cut-off points on DBC scales which distinguish best between psychiatric cases and non-cases. Therefore, the application of the DBC in non-selective samples of referred children with ID should be a major focus in future research.

Another issue to be addressed regards the question of which kinds of instruments are best suited to the assessment of behavioural and emotional

problems in children with borderline intellectual functioning, or children with developmental disabilities and normal IQ, such as Asperger's Syndrome. In addressing these issues, the incremental value of the DBC over ratings scales developed for children from the average population needs to be assessed.

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